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A Slave-making *Leptothorax*. (Hymen.: Formicidae)¹.

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A single colony of an interesting new species of *Leptothorax* was taken in a large oak gall near Jackson, Ohio, near the end of July, 1935.

Leptothorax (*Mychothorax*) *duloticus* sp. n.

Worker: (Fig. 1), length 2.4-2.6 mm. Head longer than broad, somewhat narrower in front than behind; the posterior

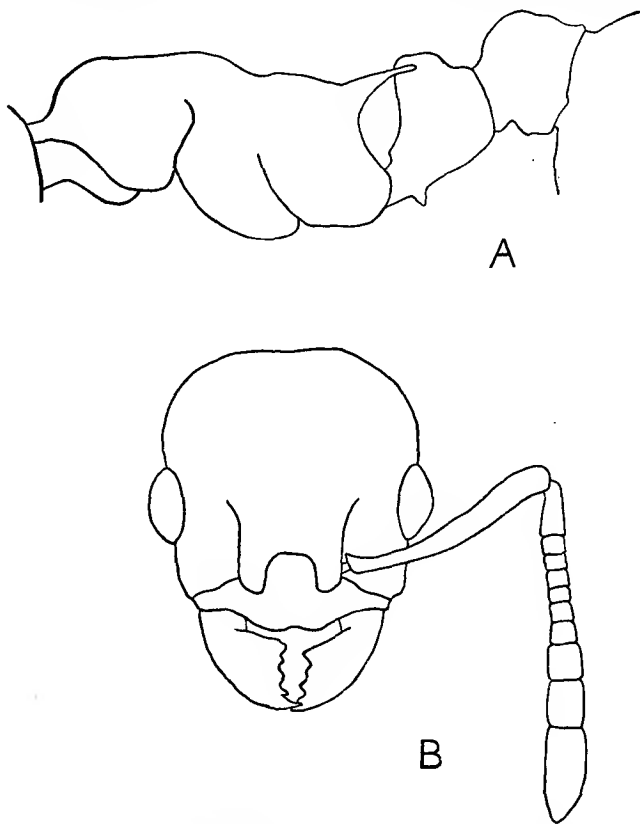


Fig. 1. *Leptothorax duloticus* sp. n. A. thorax of worker in profile. B. head of same from the front.

¹ Contribution No. 19 from the Dept. of Biology of Haverford College.

corners broadly rounded, the posterior border faintly excised. Mandibles 5-toothed, robust; teeth coarse, short and blunt. Clypeus convex, not impressed in the middle; the anterior border narrowly and rather shallowly notched in the middle, the sides sinuate. Antennae 11-jointed; scape extending to the posterior border of the head; first funicular joint as long as the succeeding joints; joints 2-7 slightly broader than long; remaining 3 joints forming a distinct club which is nearly as long as the remainder of the funiculus. Eyes broadly oval, large, the longest diameter equal to $1/4$ the length from base of mandibles to posterior corner of head.

Thorax moderately robust, the humeral angles rounded. Mesoepinotal constriction broad and shallow. Promesonotal suture distinct. Epinotal spines long, thick, blunt, divergent, somewhat recurved; length about $1\frac{1}{3}$ times the distance apart at their bases and about as long as the epinotal declivity. Petiole viewed from above with sides straight and subparallel; about $1\frac{1}{4}$ times longer than broad. Node high; in profile, the anterior slope is slightly concave; the posterior slope shorter, strongly convex, subangulate; seen from the rear the node is compressed, the summit somewhat concave with angular corners. Ventral tooth prominent, directed downward. Postpetiole seen from above slightly greater than $1\frac{1}{2}$ times the width of the petiole; in profile the dorsal surface is convex and evenly rounded; the anterior angles prominent but obtuse. Gaster and legs of the usual shape for *Mychothorax*.

Head, thorax, petiole and postpetiole very densely and coarsely punctate; in addition the head bears faint irregular rugae on the front and vertex, coarser and subparallel rugae on the cheeks and around the antennal insertions; top of thorax bearing faint irregular rugae. Mandibles feebly shining, with sparse, irregular, longitudinal striations. Clypeus rather shining, with several longitudinal rugae. Epinotal declivity, gaster and legs smooth and shining.

Body bearing sparse, long, erect, obtuse hairs on vertex of head, thorax, petiole and postpetiole; less obtuse and more numerous on the gaster. Antennae, legs and gaster bearing acute, fine reclinate hairs, rather dense on the antennae, less numerous on the gaster and legs.

Color light brown; funiculi and a band across the middle of the gaster darker.

Female: length 3.25 mm. Anterior margin of clypeus shallowly but distinctly emarginate. Antennal scape reaching to midway between the eye and the posterior corner of the head.

Eyes and ocelli large. Thorax stout, of the usual female shape; showing distinct traces of having borne wings. Epinotal spines shorter and stouter than in the worker; length about $2/3$ the distance apart at the bases. Petiolar node as seen from behind lower and more rounded than in the worker.

Head, petiole and postpetiole rather densely punctate, the punctures wide and shallow giving a subreticulate appearance; faintly shining and distinctly rugose. Clypeus shining, with 8-10 longitudinal rugae. Mesonotum and scutellum feebly shining, with fine sparse longitudinal rugae. Pleurae shining, finely and sparsely punctate. Pronotum and epinotum finely, irregularly and rather closely reticulate-rugose, the rugae with a longitudinal trend. Gaster and legs smooth and shining. Integument covered with scattered fine appressed hairs which are more numerous on the antennae; front and vertex of head, thorax, petiole, postpetiole and gaster with additional long erect slender pointed yellow hairs.

Color light brown with a darker band across the middle of the gaster; antennal insertions and a ring around each ocellus, black.

The 11-jointed antennae, marked mesoëpinotal constriction and the general shape of the petiole definitely place *L. duloticus* in *Mychothorax*. Apparently close to *L. (M) hirticornis*, it is easily separated from that species by the well-defined notch in the anterior border of the clypeus, the long rather thickened spines, the long erect obtuse hairs, and the normal character of the female thorax. Other salient characters of the species are the large eyes, the coarsely and densely punctured integument and the long antennal scapes.

Described from a female and 4 workers which are deposited in the author's collection.

This colony, when opened, was found to contain, in addition to 5 *L. duloticus*, 11 workers of *L. curvispinosus* and 12 workers of *L. longispinosus*. Both of these latter species were abundant in the locality. The mixed colony arose either by the adoption of a *duloticus* female into a mixed *curvispinosus-longispinosus* colony, or through slave raids by *duloticus* workers on one or both of these species. That the former method is highly improbable is indicated by the very infrequent discovery of mixed *curvispinosus-longispinosus* and of *duloticus*

colonies. That *duloticus* is indeed a slavemaking species is borne out by the following observations.

The *duloticus* colony, together with its accompanying *curvispinosus* and *longispinosus* workers, was transferred to an artificial nest, and a colony of *curvispinosus* in a twig, broken open to expose the brood, was placed about 3 inches away. The temperature was quite warm. The *duloticus* were very active, spending a considerable portion of their time running agitatedly around the nest. In about 20 minutes a worker *duloticus* found the *curvispinosus* nest and began to examine it. She was soon seized by a *curvispinosus* worker, but after they had fought for a few minutes they separated. The *duloticus* worker continued her exploration for a few minutes until she found an unguarded pupa, which she picked up and carried back to the home colony. The arrival of the pupa caused a little excitement in the *duloticus* nest. About 5 minutes later she returned to the *curvispinosus* colony followed by a second *duloticus* and two *curvispinosus* workers. The latter soon grappled with workers from the introduced colony while the two *duloticus* each picked up a pupa and returned to their nest with them. Meanwhile a third *duloticus* found the colony, picked up a pupa and returned to her nest with it. These three *duloticus* continued to return at irregular intervals and carry off the *curvispinosus* brood until they had taken all but some eggs and young larvae which were being carried about by the *curvispinosus* workers of the raided nest. The *curvispinosus* submitted almost without resistance, in the main quietly allowing the *duloticus* to walk among them. Occasionally one offered resistance but the combats never lasted more than a few minutes, ending either with the flight or injury of the *curvispinosus*. The whole procedure was slow and unsteady, requiring nearly 2½ hours to carry off some 14 pupae and larvae, and would undoubtedly have taken considerably more time had the *curvispinosus* resisted very much. Probably this passivity was due to demoralization of the colony when it was opened.

In the artificial nest the *duloticus* were often observed to drink honey and occasionally to tend the brood: observations

which would indicate that these ants are not wholly dependent on their slaves for support. When moving from one nesting site to another, the *duloticus* were carried by the *curvispinosus* and *longispinosus* workers.

These observations immediately suggested a comparison between *L. duloticus* and *Harpagoxenus*. *Harpagoxenus* is the only other genus known to enslave species of *Leptothorax*; and it is closely related to the subgenus *Mychothorax* of *Leptothorax*, from which it probably arose.² *Harpagoxenus* includes only two species, one in Europe and one in the eastern United States. Both species are advanced obligatory slavemakers, and both display many highly specialized morphological characteristics. Of the origin and development of the highly specialized behavior of *Harpagoxenus*, there has been no inkling. It is this gap between *Harpagoxenus* and the independent species of *Mychothorax* which *L. duloticus* with its primitive slavemaking behavior as indicated by the disorganized character of its slave raids, the apparent absence of specialized structural characteristics and the survival, in attenuated form perhaps, of most of the instincts of independent *Formicidae*, can fill; taking a position between them which is analogous to the position of *Formica sanguinea* between *Polyergus* and *Formica fusca*. There is no apparent indication that *L. duloticus* is on the direct line of descent of *Harpagoxenus*, or even that the two forms arose from an immediate common ancestor. It is quite possible that *L. duloticus* is a distinct branch of *Mychothorax*, a group which shows a very strong general tendency toward symbiotic habits. Discovery of the male of *duloticus* will probably shed considerable light on the phylogenetic relationships of that species. But whether *Harpagoxenus* and *L. duloticus* had a common ancestor, or whether they arose independently, there can be little doubt that *L. duloticus* is probably very close to an hypothetical early stage in the evolution of the form of slavemaking behavior whose highest development is displayed by *Harpagoxenus*.

² Creighton, *Harpagoxenus americanus* slave raids pp. 11-26 Psyche 34, 1927.